Psych 102: Methods for Research in Psychological Sciences

General Information

Lecture: TBD
Location: TBD

Sections:
TBD

Important Note: Students must come to lecture and section with a laptop with R and R Studio installed.

Instructor:TBD
Email: TBA
Office Hours: TBD
Location: TBD

GSI: TBD
Email: TBA
Office Hours: TBD
Location: TBD

Course Description.

This is an upper-division course designed to introduce students to the data analysis techniques used by psychologists. Students will also learn basic programming skills in R. This course serves both as a refresher of basic statistics and as a preparation for more advanced courses in statistics and data analysis. The course will cover some statistical theory, but primarily will be focused on learning data analysis strategies to test hypotheses in psychological science. This course will be a good fit for students interested in pursuing graduate school in psychology, neuroscience, or related fields. The course will cover statistical tests that are part of the generalized mixed effect model: linear regression, multiple regression, and logistic regression; analysis of variance (ANOVA) and analysis of covariance (ANCOVA); and factorial, repeated measures, and mixed designs. We will also discuss data visualization, data manipulation, and data reduction techniques in R. Depending on students' interests, other advanced topics such as longitudinal data analysis, mediation, and/or regularization methods may also be discussed.

Psychology major program learning goals

As part of a campus-wide project to improve undergraduate education, the Department of Psychology has identified a number of program-level goals which should be addressed by its

courses. Here is the current list of goals, as well as a summary of how Psychology 102 intends to meet them, with particular emphasis on program learning goals 5 and 6

1. Understand basic concepts that characterize psychology as a field of scientific inquiry, and appreciate the various subfields that form the discipline as well as things that differentiate it from other related disciplines. **Examples from the text, lecture, and section will focus on psychology as a field of scientific inquiry.**
2. Develop an understanding of the central questions/issues in contemporary psychology as well as a historical perspective of psychological theories and key empirical data. **Throughout the course, students will be exposed to central issues in contemporary psychological science such as reproducibility and replicability.**
3. Develop a thorough understanding of one of the major content areas of psychology (i.e., Social/Personality, Developmental, Clinical, Cognitive, Biological). **Examples from the text, in lecture, and section will cover these content areas of psychology.**
4. Develop skills to critically evaluate the presentation of scientific ideas and research in original scientific papers as well as in the popular media. **Students will gain an understanding of how to critically evaluate research findings reported across various settings.**
5. Become familiar with research methods used in psychological research, and become proficient in basic concepts of statistical analyses and familiar with more advanced methods in data analyses and modeling. **The goal of this course is for students to gain proficiency in both basic and advanced methods in data analyses and statistical modeling.**
6. Learn to develop, articulate, and communicate, both orally and in written form, a testable hypothesis, or an argument drawing from an existing body of literature. **The final project for this course involves developing, testing, and evaluating hypotheses using data analysis and statistical modeling.**
7. Apply a psychological principle to an everyday problem, or take an everyday problem and identify the relevant psychological mechanisms/issues. **Examples from the text, in lecture, and section will cover these aspects of psychology. Furthermore, students are encouraged to use data they have collected for their honors thesis for the final project.**

Textbook

Required:
"Field": *Discovering Statistics Using R*. Andy Field, Jeremy Miles and Zoë Field. 2012. Sage Publications. First Edition.

*Recommended but **NOT** required*:

- An R Companion to Applied Regression. John Fox. Sage Publications. Second Edition.
- Applied Regression Analysis and Generalized Linear Models. John Fox. Sage Publications. Third Edition.

A few recommended (free) online resources:

- https://studysites.sagepub.com/dsur/study/default.htm: companion site to Field textbook

- https://stats.idre.ucla.edu: Excellent site maintained by UCLA that has resources specific to R, but also about statistics in general
- https://stats.stackexchange.com: Q&A about statistics
- https://stackoverflow.com: Part of the Stack Exchange network. Q&A primarily about programming.

Software

We will use R, a programming language designed for statistical computing. R is available free online from the R Project website, https://www.r-project.org/. We will also use RStudio, and interactive development environment designed for use with R. RStudio is also free. (Download the open source version of RStudio Desktop from https://www.rstudio.com/products/rstudio.) RStudio requires an active R installation. Download the latest version of R and RStudio.

Prerequisites

Undergraduate Statistics for Psychology (Psych 101). I'll assume that you are familiar with the concepts described in chapters 1, 2, 6, and 9 in Field.

Course Logistics, Assignments and Tests.

The course meets on TBD for lecture sessions, which will primarily include hands-on computer tutorials. Section meets on TBD. Attending section is mandatory. During section, you will receive additional tips and guidance. You will be able to work on your homework during section.

Tests include two in-class midterms and one take-home final exam. The final exam will be assigned on the last day of class and will be due via bcourses on the scheduled final exam date. There also will be a final project that involves a detailed analysis of a data set chosen by the student (due on last day of class).

Please check bcourses often for announcements and changes to the schedule. It is important that your email address on bcourses is correct/active and your notification settings are set to "ASAP". We will use bcourses announcements and email communication in this class, so it is important that you receive those emails as it is your responsibility to keep up with course updates/changes.

Email and asking questions

Please do your best to ask your questions in lecture/section or office hours. You will receive more thorough explanations by asking questions in person, as we cannot respond to lengthy emails. We will often ask you to visit us during office hours if you email a question that requires more than a few sentences to answer. If you have larger conceptual questions that will take time to discuss, bring these to office hours. We will do our best to respond to emails promptly (i.e., within 24 hours on weekdays and 48 hours on weekends). Please avoid emailing questions the night before an exam or assignment is due; it is unlikely that we will be able to respond to you in time.

For questions about running a particular analysis or programming in R, please make a good faith attempt to solve the problem yourself first. To this end, for any questions you email or post to the discussion on bcourses, we ask that you provide a brief description of what you have tried so far with reference to at least two of the following resources:

- Field textbook (mention what chapter and/or pages you have referred to)
- Lecture or discussion materials
- Google/stackexchange/stackoverflow
- Package documentation (e.g., https://cran.r-project.org/web/packages/reshape/reshape.pdf)

Disabled Students' Program
If you have an accommodation letter from the DSP, please have it sent to both the instructor and the GSI as soon as possible. If you require accommodations but do not have a letter, please see the DSP office.

Grades

Grades will be calculated as:
10% Participation
20% Homework
30% Final Project
10% Midterm 1
10% Midterm 2
20% Final Exam

Final grade calculation: At the end of the semester, your letter grade will be determined either by traditional cutoffs (i.e. A's in the 90s, B's in the 80s, etc.) or by a curve, whichever leads to higher grades.

Participation
The participation category includes a wide range of activities, including short in-class and online activities, attendance in section, and/or asking substantive questions (i.e., about the course material, not "when is the final?"). 10% will be deducted for an unexcused absence (so 1% of the total grade per absence). You will be given one "free pass" with regards to absences.

Homework
There will be 8-12 homework assignments during the semester. Homework will be due one week after it is assigned before lecture on bcourses. Exceptions will be announced on bcourses. Homework will be graded on the following scale:
0: missing, more than 24 hours late, or less than 50% complete.
1: Poor effort, late by less than 24 hours, or incomplete.
2: Good effort, though some answers may be wrong.
3 (Bonus): Exceptional & answering optional questions.
All "2"s would give you a perfect homework score. Scores of "3" will not happen often and are considered extra credit. You are encouraged to work collaboratively on the homework, but please write your own solutions. I will also drop your lowest homework score.

Class Schedule

Week	Topic	Reading
Week 0		
TBD	Class introduction and installing R	
Week 1		
TBD	Basic statistical concepts	Field: Chapters 1 and 2
TBD	Data manipulation and data reduction in R	Field: Chapter 3
Week 2		
TBD	No class: Labor Day	
TBD	Exploring data with graphs in R	Field: Chapter 4
Week 3		
TBD	Data assumptions	Field: Chapter 5
TBD	Linear regression: introduction	Field: Chapter 7
Week 4		
TBD	Multiple regression and assumptions	Field: Chapter 7
TBD	Logistic regression: introduction	Field: Chapter 8
Week 5		
TBD	Catch up/review	
TBD	Midterm 1 (in-class)	
Week 6		
TBD	Analysis of variance (ANOVA) and the general linear model (GLM)	Field: Chapter 10
TBD	ANOVA and ANCOVA	Field: Chapter 10 and 11

Week 7		
TBD	Factorial ANOVA	Field: Chapter 12
TBD	Moderators	Field: Chapter 12
Week 8		
TBD	Repeated measures and mixed designs: intro to hierarchical linear models (HLM)	Field: Chapter 19
TBD	Hierarchical linear models (HLM)	Field: Chapter 19
Week 9		
TBD	Hierarchical linear models (HLM)	Field: Chapter 19
TBD	Catch up/review	
Week 10		
TBD	Midterm 2 (in-class)	
TBD	MANOVA and discriminant function analysis	Field: Chapter 16
Week 11		
TBD	Factor analysis and principal component analysis	Field: Chapter 17
TBD	Lasso regression	McNeish, 2015 (bcourses)
Week 12		
TBD	No class: Veteran's Day	
TBD	Mediation	To be assigned
Week 13		
TBD	Mediation	To be assigned

TBD	No class: Thanksgiving	
Week 14		
TBD	Current topics in psychological science: reproducibility and replicability; multiple comparisons and False Discovery Rate; The New Statistics	Cumming 2014; other readings to be assigned
TBD	Class review, take home final exam assigned, final paper due	
Weeks 15-16		
TBD	RRR	
TBD	RRR	
TBD	Final exam (Take home, due on bcourses)	

Final Project.

The final project involves modeling and analyzing a data set of your choice. Preferably, the data set is one that you have collected or help collected as part of your honor thesis. I also encourage you to use public use datasets. Talk to me or your GSI if this is an option you are interested in pursuing. You can also use datasets that come with R, but if you chose one from an R package, you cannot repeat an analysis that is already published. The final project is due on the last day of class.

Final Project Outline.

Introduction. State the question/hypothesis that lead to the data acquisition with brief theoretical framework. Finish this introduction with a statement that says how this new dataset addresses the question. This introduction should be one or two paragraph and include 2-5 critical references. The goal here is not to provide a thorough literature review but just to tell the reader why you're analyzing this dataset and what question you'll be trying to answer (10 points).

Methods. Describe how the data was collected and the subject pool. 1 paragraph, or 2 short paragraphs. The idea is to highlight the key features of the data that will help the reader interpret the results, and not necessarily to provide all the details necessary for replicating the study. (10 points)

Results/Data Display. Create figures to illustrate the major patterns in the data (e.g., mean (by group if applicable), standard deviation, intercorrelations, etc.). I expect 2 to 5 figures. The axis of the figures should be labeled and the figures need a title. Each figure will also need a short figure legend that you can write in your word processing software. Embed the figures in your text. (20 points including the R code which will be in the Appendix)

Model Description. State what your competing models are both in English and with equations. The competing models can be just the null model (no covariates) and a particular model that corresponds to your hypothesis. But you can also decide that it is more relevant to compare different complex models. (10 points).

Model Fitting and Reporting Statistics. Fit the parameter in your models and give short interpretations for the values of the coefficients. Additional figures might be helpful but are not required. This section will be most similar to the results section found in research papers (30 points including R code).

Analysis of model appropriateness. Assess the appropriateness of the model(s) you used. Do your data seem to violate the model's main assumptions? Use data displays and/or hypothesis tests to make your case, and discuss the implications. (10 points)

Discussion/Conclusion. Write a brief discussion of your modeling efforts, the statistical analysis and the implications for the question that was raised in the introduction. One or two paragraphs. (10 points)

Appendix. R code.